PROPOSED ACTION PURPOSE AND NEED
Storrie Meadow Restoration Project

USDA Forest Service

Almanor Ranger District, Lassen National Forest

Butte and Tehama Counties, California

Introduction

Almanor Ranger District (ARD) of the Lassen National Forest (LNF) is proposing the Storrie Meadow Restoration project (hereafter theproject). The the project area encompasses approximately 220 acres of National Forest System lands administered by the ARD of the LNF. The Storrie project proposal stems from an assessment and prioritization effort for 90 meadows within and adjacent to the Storrie Fire of 2000. The goal of the assessment and prioritization effort was to identify the highest priority meadows in need of restoration in order to restore the ecological integrity and function of the Storrie Fire nexus watersheds, improve habitat for special status species (e.g., Willow Flycatcher, Cascades Frog), and improve water quality and late season base flows within the meadows. The assessment and prioritization were planned and carried out by the US Forest Service Point Blue Conservation Science and Forest Creek Restoration. The partnership was formed to assist the LNF with watershed improvement projects.

Three priority meadow systems were identified for restoration: 1) Colby Creek; 2) Willow Creek West; and 3) Snag Lake. Colby Creek and Willow Creek West are perennial headwater tributaries of Butte Creek, which flows into the Sacramento River near Chico, CA. Snag Lake lies at the headwaters of the West Branch Feather River, which flows into Lake Oroville. The headwater of the West Branch Feather River in the Snag Lake Meadow is intermittent, with flows usually ceasing in July. The amount and duration of flow for each meadow system is dependent on the annual precipitation and snowpack, creating highly variable stream flows from year to year.

Project Location

The Colby and Willow Creek West project areas are roughly 20 air miles southwest of Chester, Plumas County, California. Included are portions of Township (T) 26 North (N), Range (R) 4 East (E), Sections (S) 2,3,11,12,13,14,34, and 35; of the Mount Diablo Meridian (Figure 1) . The Snag Lake project area is roughly 2.5 air miles south of the Colby and Willow Creek West sites, and is in Township T26N, Range 5E, Section 30.

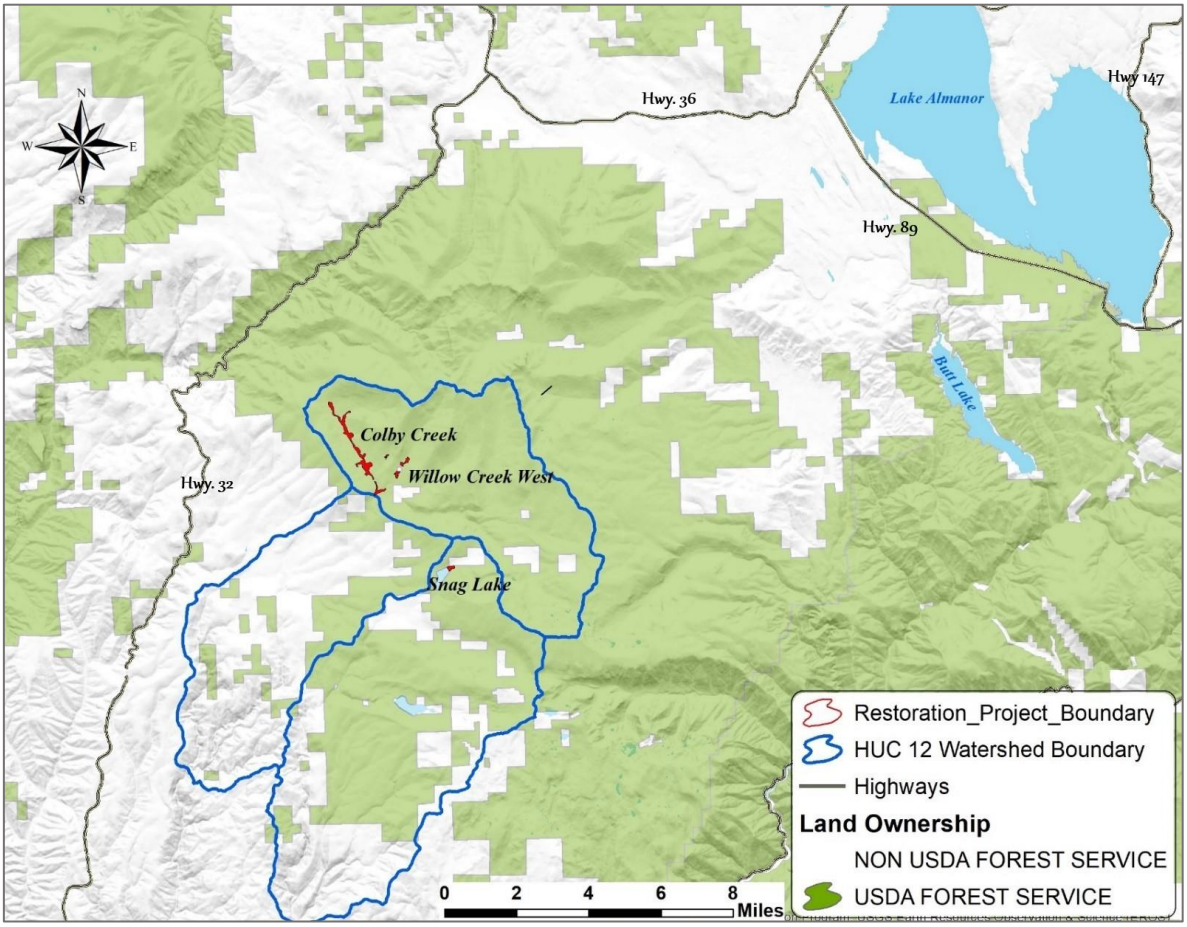

Figure 1: Vicinity map of Storrie Meadows Restoration project.

The project occurs in the headwater portion of each meadow system. Anadromous fish do not reach all the way upstream to Colby and Willow Creek though the cold clean water these fisheries depend on emanate from these headwater meadows. Colby and Willow Creek have historically provided habitat for other sensitive species (e.g. willow flycatcher, Cascade's frog). While Chinook salmon are dependent upon the waters that flow out of these meadows, they do not occur within the project area. Project work would occur over approximately 169 acres total in the 5th field watershed of Colby Meadow, approximately 25 acres in the 5th field watershed of Willow Creek West Meadow, and approximately 12 acres in the 5th field watershed of Snag Lake. None of the meadows are within active range allotments.

In most meadows within the Storrie Fire nexus, including Colby, West Willow, and Snag Lake, different plant assemblages are distributed across a hydrologic gradient as a function of flooding frequency, duration, spring contribution, and depth to groundwater. Wet meadow and riparian vegetation occur throughout these systems dominated by grass and grass-like plants such as *Juncus ensifolius*, *Carex athrostachya*, and *Carex vesicaria, woody plants such as willows (Salix spp.), Alders (Alnus spp.), occur throughout.* These species occur where ground water tables are relatively high near streams and on the adjacent floodplain where groundwater discharge contributes to the wet

conditions. Conifers, dominated by lodgepole pine (*Pinus contorta*) are present on the margins and have encroached densely in near stream environments throughout these meadows.

Colby and Willow Creek West are particularly important because they have significant spring contributions to them and are headwater perennial reaches that provide flow for Butte Creek. Butte Creek has been identified as critical to the viability of Central Valley Spring-run Chinook salmon (*Oncorhynchus tshawytscha*), as it is one of five remaining remnant runs in the Central Valley population. The Central Valley Spring-run Chinook is listed as threatened under the State and Federal Endangered Species Acts.

Background

Wet meadows are among the most unique habitat types in the Sierra Nevada. Access to perennial water and distinctive soil types lead to unique plant communities from the adjacent upland (Kondolf et al. 1996). Meadows are also disproportionately valuable compared to the area they cover in the Sierra Nevada for the ecological services they provide (Kattlemann & Embury 1996; Kondolf et al. 1996). Ecologically functional montane meadows are hotspots for biodiversity in the Sierra Nevada (Kattlemann & Embury 1996), and provide vital services such as flood attenuation, sediment filtration, water storage, and water quality improvement (DeLaney 1995; Woltemade 2000; Hammersmark et al. 2008), carbon sequestration (Povirk et al. 2001), and livestock forage (Torrell et al. 1996). Though less than 1% of the area of the Sierra Nevada is comprised of riparian habitat (Kattlemann & Embury 1996), approximately one-fifth of the 400 species of terrestrial vertebrates that inhabit the Sierra Nevada are strongly dependent on riparian areas such as meadows (Graber 1996). The Sierra Nevada's meadows also support several rare and declining bird species.

The majority of meadows in the Sierra Nevada have undergone a long history of degradation to a state that is less productive, supporting fewer species and individuals of native animals and plants, and providing fewer ecological services (Ratliff 1985; Knapp & Matthews 1996; Castelli et al. 2000; Sarr 2002; Krueper et al. 2003). Grazing, timber harvest, roads, culverts, dams, diversions, mining, and alien species invasions have all contributed to meadow degradation (Ratliff 1985). While some meadows have been resilient to these impacts, once a threshold has been passed many of these systems cannot readily recover on their own (Allen-Diaz 1991; Micheli & Kirchner 2002; Chambers et al. 2004; Briske et al. 2008). Restoration to reverse the decline in meadow health has become a management priority in the Sierra Nevada region (NFWF 2010) because of their high ecological value and limited landscape extent.

In 2000, the Storrie fire burned 27,000 acres within the Lassen National Forest resulting in alterations to stream conditions and wildlife habitat. A high concentration of meadows occur within the upper reaches of the watersheds affected by the fire and many were in a degraded state prior to the fire, further impacting watershed condition and wildlife habitat.

A multi-step process was implemented to identify priority meadows for restoration in the Storrie watersheds. The LNF first identified, field delineated, and conducted an initial meadow condition assessment of all 90 meadows using the American River Scorecard (American Rivers 2012). Point Blue, in collaboration with LNF and Forest Creek Restoration, developed an approach to identify priorities for restoration using these initial assessments along with the first draft of the Sierra

Meadow Prioritization tool (Vernon 2019a). From this process 21 candidate meadows were identified. Point Blue, Forest Creek Restoration, and LNF staff then visited each of the 21 meadows to narrow this list to the top 5 to 10 priority meadows for restoration. A detailed description of this prioritization process is described in Vernon et al. (2019b).

The Colby Creek, Willow Creek West, and Snag Lake meadows were identified as priorities for restoration because of their ecological attributes, their current degraded state, and potential to address this degradation through existing meadow restoration techniques (Figures 3-10). Field based assessment identified multiple impacts that have degraded meadow form and function including stream channel incision and conifer encroachment.

Laws, Regulations, and Other Direction

The proposed action is designed to be consistent with the 1992 Lassen National Forest Land and Resource Management Plan (LRMP) and 1993 Record of Decision (ROD) as amended by the Sierra Nevada Forest Plan Amendment (SNFPA) FSEIS and ROD (2004), and the SNFP Management Indicator Species Amendment (2007), sections 401 and 404 of the Clean Water Act, and other relevant Federal and State laws and regulations.

This project specifically meets the goals and strategies for water and riparian management direction in the LRMP as amended by the Sierra Nevada Forest Plan Amendment (SNFPA ROD pg. 33; Riparian Conservation Objectives #s-2, 3, 5 and 6). This project also aligns with the Region 5 Ecological Restoration Leadership Intent (USDA FS, 2011) and the Sierra Meadows Partnership (Drew et al. 2016).

As outlined in the 36 CFS 220.6 and Forest Service Handbook 1909.15, section 30, a proposed action may be categorically excluded from further analysis and documentation in and environmental impact statement (EIS) or environmental assessment (EA) only if there are no extraordinary circumstances related to the propose action. The Storrie Meadows Project fits under the following Excluded Categories;

- 36 CFR 220.6 (e)*(6) Timber stand or wildlife improvement activities that do not include the use of herbicides or do not require more than 1 mile of low standard road construction.*
- 36 CFR 220.6 (e)*(7) Modification or maintenance of stream or lake aquatic habitat improvement structures using native materials or normal practices.*
- 36 CFR 220.6 (e)*(18) Restoring wetlands, streams, riparian areas or other water bodies by removing, replacing, or modifying water control structures such as, but not limited to, dams, levees, dikes, ditches, culverts, pipes, drainage tiles, valves, gates, and fencing, to allow waters to flow into natural channels and floodplains and restore natural flow regimes to the extent practicable where valid existing rights or special use authorizations are not unilaterally altered or canceled.*

An extraordinary circumstance is when a 'normally excluded action may have a significant environmental impart' (40 C.F.R. 1508.4). Resource conditions that should be considered in determining weather extraordinary circumstance related to the proposed action warrant further

analysis and documentation will be assessed and a determination would be made if this project warrants further environmental analysis in either an EA or an EIS.

Purpose and Need

The purpose and need and proposed actions presented here were developed from professional input of the ARD and LNF specialists and staff, Storrie Fire Meadow Restoration Prioritization (Vernon et al., 2019b), Colby Creek, Willow Creek West, and Snag Lake Restoration Design Reports (Forest Creek Restoration 2020), LiDAR data, and collaborative meetings with the LNF and project partners. Six objectives were identified.

Objectives:

- Restoration of natural hydrologic function characterized by lateral connectivity between the stream channel and the floodplain, contributing to groundwater recharge, late season stream flow, and attenuation and delay of peak flows.
- Restoration of groundwater levels occurring within the plant rooting zone, supporting a wet meadow-associated plant community.
- Restoration of water quality characterized by low turbidity and cool water temperatures.
- Restoration of aquatic habitat that supports native amphibians and cold-water native fish.
- Restoration of high-quality riparian wet meadow habitat for meadow birds.
- Restoration of productive, healthy soil characterized by high levels of soil organic matter.

Existing Condition:

Colby Creek and Willow Creek West join in the southwestern portion of the meadow system before joining Butte Creek thereafter. Both creeks were affected by past land management practices including current or former roads/culverts and historic logging practices that removed large wood from within and adjacent to the creeks, and historic grazing. The failure of culverts combined with other disturbances caused Colby Creek and Willow Creek West to incise into degraded reaches within their meadows creating an entrenched stream channel. Snag Lake Creek has three small incised channels with associated headcuts. The creation of Snag Lake and subsequent flooding of the most downstream reaches of the channels created the entrenched channel reaches.

Historically, each meadow supported a multi-threaded channel system where floodplain cross sectional area was flat, or a single threaded system where it was tilted to one side of the valley. Reference reaches persist in a few locations of each meadow, where channel capacity is small (e.g. 5-10 ft2), streambanks are stable, and no headcutting occurs into adjacent fens (herein used synonymously with peatlands) or discharge slope meadows. Refer to Weixelman et al. (2011) for meadow "types." The base elevation of the all creeks in the degraded reaches are significantly lower than the pre-disturbance elevation; this reduces the overall functionality of the stream and the adjacent floodplain. With a lower stream channel elevation, the meadow drains more quickly, dropping the water table, and limiting the degree to which flood flows access the meadow area to rehydrate the alluvium and recharge the water table below. The functional floodplain is reduced in size and extent due to the lower base elevation, with wet and mesic perennial grasses, sedges, rushes, and forbs confined to the stream channel and replaced by annual grasses and lodgepole pine in the former floodplain. Increased energy in these entrenched channels results in increased bank and bed

erosion. In addition, the lowered base elevation results in discontinuity with adjacent fens and discharge slope meadows, causing channelization to occur within them.

An existing culvert under FS Road 26N59 along Colby Creek is undersized and results in unstable streambanks upstream and downstream of the creek crossing contributing to channel incision in these reaches. Short sections of previously decommissioned roads cover former wetland areas and consist of bare soil and upland vegetation.

Erosion rates and sedimentation are moderate within the watersheds; this is due to several factors, including surface flows that are from snowmelt and concentrated rain events, moderate landscape relief, and volcanic soils with high infiltration rates. Most sediment transport in the creek is derived from local bed and bank erosion. At each meadow, entrenched stream channel reaches are present and actively eroding laterally, and in some instances vertically, and banks regularly slough off during significant flow events.

Desired Condition:

The desired condition for each meadow area is to achieve natural hydrologic function with a stream channel that allows flood flows to access the floodplain without headcutting and channelization into adjacent fens and discharge slope meadows. The associated meadow plant community would be dominated by wetland forb and graminoid species with sporadic dense stands of woody shrubs (e.g. willow and alder) across the entire floodplain. There would be fewer encroaching lodgepole pine. The meadows would include a diverse suite of aquatic and riparian habitats for fish, amphibians, birds and other organisms adapted to wet meadow conditions. Stream channels would be stable and vegetated, reducing erosion and sediment while providing habitat complexity for fish. Each meadow system would moderate flood flows, reduce flow velocity, and dissipate energy to prevent excessive erosion and channel instability, with dynamic flow paths that can adjust to landscape stressors and changing climate conditions. The Colby Creek for Forest Service Road 26N59 would provide adequate flood flow passage and reduce streambank erosion upstream and downstream of the culvert. Decommissioned roads would be recontoured and allow meadow vegetation to return.

Need for Action:

The degraded meadows within the project are unlikely to self-correct to achieve the desired conditions and thus achieve project objectives without intervention. Without action, the meadows would continue to degrade, further reducing the ecological services they provide. Restoring floodplain function and water table elevation would in turn promote wildlife habitat, encourage the growth of meadow vegetation, increase net soil carbon sequestration, reduce erosion, attenuate flood events, and increase the duration of flows throughout the dry season. While roads play a vital role in providing access for resource management, wildland fire suppression, and public use, they are often the source of degradation in meadow systems. This project includes minimizing and reversing adverse ecological impacts from road crossings in meadows.

Proposed Action

Reconnecting Colby, Willow Creek West, and Snag Lake Creek to their floodplains would achieve the desired condition. Above and below Colby and Willow Creek West meadows are cobble and boulder dominated stream reaches that provide natural grade control for the meadows, which decreases the

risk of failure for the proposed restoration activities. In order to restore each meadow area a series of actions would be required to reconnect their streams to the historic floodplain. These actions include 1) placing and building wood based structures ,2) earthen channel fill 3) removal of encroaching conifers, 4) 4) recontouring roads and replacing/removing culverts. The following sections provide details on each of these four actions.

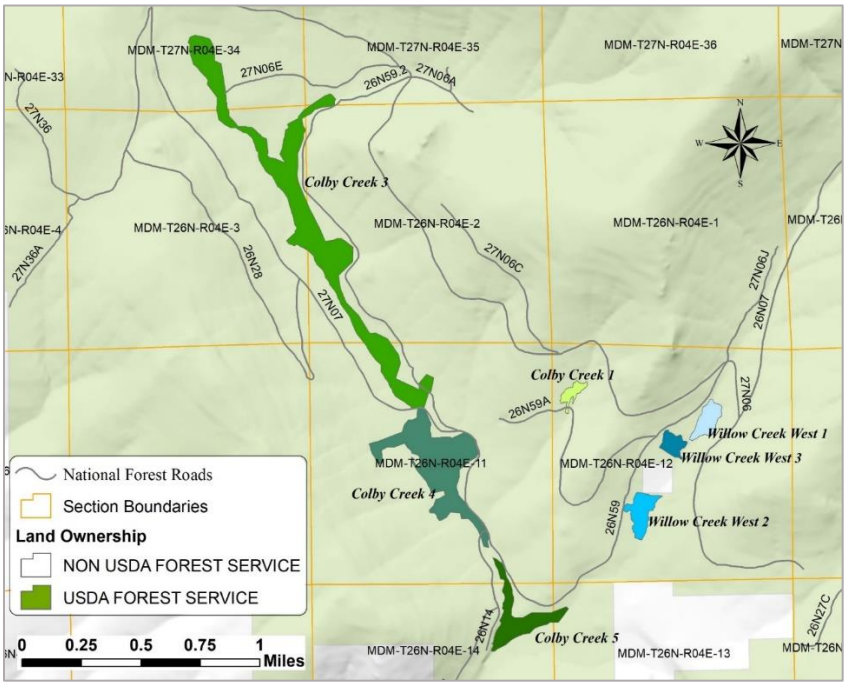

Figure 2: Detail Map of Colby Creek and Willow Creek West Meadows.

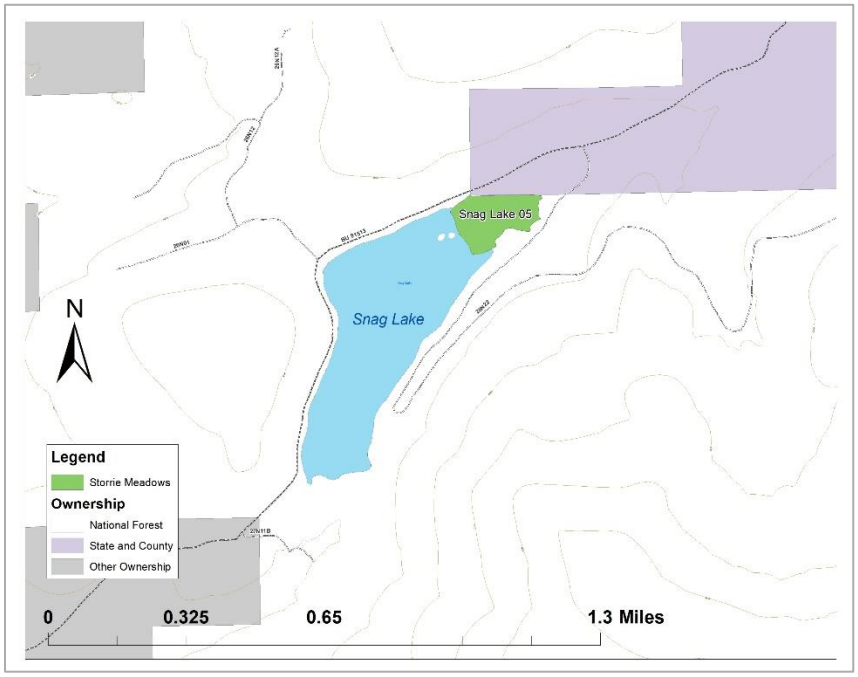

Figure 3: Detail Map of Snag Lake Meadow.

Wood-Based Structures

Entrenched channel reaches in Colby, Snag, and Willow Creek West will have approximately 165 wood-based structures referred to as either Post Assisted Log Structures (PALSs) or Beaver Dam Analogues (BDAs). These structures would be constructed from native materials by hand crews (Figures 3-10). The distinction between PALS and BDAs follows Wheaten et al. (2019), as do general construction techniques. While both types of structures include driven posts into the stream bed and banks, with extensive additions of trees, branches, and roots, BDAs include finer material packed into the structure with the intent to provide a partial water seal to reduce flow through the structure. The height of PALS/BDAs serving to redirect flow would be set equal or slightly higher (1-2 inches) above the top of banks. The height of PALS/BDAs serving to provide grade control would be set slightly lower in the center of the structure so that the greatest water surface height flowing over the structure is positioned in the center for those spanning the channel. This criterion is intended to mimic natural riffles that often have a concave shape. The decision to make a structure less porous (i.e. BDA) is based on the location of nearby headcuts or fens. BDAs are preferred in order to create a backwater effect to arrest headcuts within the channel or adjacent peatlands.

Design criteria for PALS/BDA locations include: 1) creating continuity of floodplain access and grade control; 2) anchoring PALS/BDA edges with existing willow clumps along the streambank; 3) aggrading incised reaches; 4) redirecting surface flow to the valley low or to remnant channels; 5) ensuring aquatic organism passage; 6) retaining some existing deep pools; and 7) backwatering headcuts or the upstream base of a PALS/BDA.

Hand crews would build all BDAs and PALSs by sourcing material from conifer removal treatments (see below), cutting branches from nearby willows, and salvaging other organic material (sod, branches, tree boles) within the stream channel. Specific locations for constructing of them were selected because the area was already providing channel aggradation and material was available.

Some snags or trees less than 30 inches diameter at breast height (DBH) would be felled into stream reaches to augment large wood recruitment and be used to combine with PALS/BDAs to provide grade control within the stream. White fir and lodgepole pine trees would be preferentially chosen for felling over other tree species, particularly suppressed trees with poor form or a live crown ratio less than 30 percent. In addition, existing larger diameter trees that have fallen parallel to the channel and floodplain would be rotated or repositioned within the channel using hand crews or heavy equipment to provide a similar function to those proposed to be felled.

Earthen Channel Fill

Some short reaches of the existing incised channel of Colby Creek and Willow Creek West would be filled using nearby earthen material borrowed from higher elevation terraces (i.e. uplands) located within the project area, shown as borrow areas in Figures 3-10. The incised reaches are located at higher elevations on the floodplain compared to the lowest elevation in the valley, and a historic remnant channel is intact and capable of receiving flow in the “valley low.” Approximately 985 cubic yards of fill material would be needed for Colby, and 12,250 cubic yards for Willow Creek West. Prior to filling the channel, an excavator would be used to salvage all sod and topsoil from within the channel and place it adjacent to the channel. After fill material is transported and placed in the channel, the sod and topsoil would be replanted, and erosion control fabric staked to the surface.

Erosion control fabric, also referred to as jute fabric, is a biodegradable material used to stabilize soil and reduce erosive forces.

Several headcut features are present in the discharge slope meadows and fens in Colby (n=5) and Willow Creek West (n=2). The headcuts vary in size and are generally less than 20 feet long and 10 feet wide. Sod, soil, and wood chips bound in jute fabric shaped as “burritos'' would be placed using hand crews within the headcut areas to create a consistent slope and transition into the existing channel, floodplain, or anticipated bankfull water surface height. Organic material (i.e. broken branches, small snags) would be incorporated into the fill. Willow cuttings would be used as stakes to anchor the sod clumps and jute burritos. Hand crews would also salvage one foot by one-foot sod plugs from floodplain areas when treating headcuts in discharge slope meadows and create jute burritos by using soil at the margins of the floodplain. The sod plugs are intended to speed vegetative recovery. Hand crews would salvage small, approximately three inches by three inches sod and/or peat plugs and transplant them into the jute burritos. Any disturbed areas of the floodplain would be filled with native alluvium and small two inch sod plugs would be planted within them to speed vegetative recovery. The same technique would be used to fill small channels/rills, with the exception that material would be placed directly into the channel without enclosing it with jute fabric. Erosion control fabric would be placed and staked over most headcut and channel fill areas.

Five locations in Snag Lake Meadow are proposed for riffle augmentation. Riffles would be constructed with rock and soil immediately downstream of existing headcuts. The construction of riffles below the headcuts would create pools and dissipate the existing erosive force in the headcut area, thereby arresting upstream headcut migration. A slope of 2 to 3 percent would be constructed within the augmented riffle to dissipated energy and transition flow to the next augmented riffle, existing riffle, or PALs. Rocked riffles were chosen over PALs because they are structurally stronger and require little or no maintenance. The riffles would average twenty feet in length and eight feet wide.

Borrow areas are necessary to acquire material for earthen channel fill treatments. Five different borrow area locations are proposed to acquire fill for Colby and Willow Creek West. The borrow site at Colby 03, to place an earthen plug in the east fork Colby Creek, would come from the adjacent hill slope. A total of 400 cubic yards (cy) is needed for the earthen plug. Further south, two headcut treatments are proposed, requiring a total of 191 cy, sourced from two borrow sites adjacent to them to the east along the hillslope. Finally, five earthen plugs are proposed to fill the channel/ditch that developed between the east fork and west fork Colby Creek. For these treatments, material would be borrowed from the areas immediately above and below the proposed plug. The average quantity of each is approximately 25 cy.

Fill material needed at Colby 01 is estimated to be 374 cy. This material would be borrowed from an adjacent hillslope, and elevated former logging roadbed which would be lowered to match the former floodplain elevation.

Two different borrow area locations are proposed to acquire fill in Willow Creek West, one at WCW 01 and the second in WCW 05. The borrow site at WCW 01 would be used to place an earthen plug in Willow Creek West below the large headcut. Borrow material would be acquired from the nearby

upland area to the west. A total of 66 cubic yards (cy) is needed for the earthen plug. Fill material needed at Colby 05 is estimated to be 40 cy. This material would be borrowed from an adjacent hillslope located to the north.

All material acquired from borrow areas would be removed so that a natural shallow depression blends into the adjacent area. Organic material, including topsoil and tree branches would be spread over the borrow to promote revegetation of the area, and disturbed ground may be seeded with locally adapted native seed.

Revegetation of disturbed areas is an important component of the restoration design, particularly in areas receiving future flood flows. Flow has the potential to erode areas disturbed from treatments if they compromise vegetation, making it less resistant to flow. The extent of riparian vegetation would increase following restoration activities and vegetative communities would adapt to a community representing the changed hydrology. A combination of passive and active revegetation would be used to ensure that meadow communities recover in response to a changing l hydrologic base elevation. Passive revegetation would occur when the surrounding plant sources expand and recolonize the newly created or reformed surfaces through seeds, tillers, and rhizomes. Active revegetation involves planting seeds, plugs, and plants in areas where a more rapid vegetation response will accelerate the achievement of project objectives or reduce risk of project failure. Active revegetation of riparian hardwoods has been identified as a priority action to accelerate the response of meadow birds to restoration (Campos et al. 2020). We would utilize the Climate Smart Planting Pallet tool developed by Point Blue (Vernon et al. 2020) to identify plant species to actively revegetate in these meadows.

Revegetation of the newly filled channels would consist of spreading salvaged topsoil upon filled areas, transplanting salvaged sod, and installing purchased sod plugs. The new elevation for the lowered terraces would be slightly above the floodplain elevation and have high shallow groundwater levels, promoting the establishment of more mesic vegetation compared to existing vegetation. Therefore, revegetation of lowered terrace areas consists of two approaches, one for areas near floodplain elevations, and the second for transitional-slope areas. First, the salvaged topsoil and sod would be transplanted onto the shaved terraces. Transitional-slope areas would also receive this topsoil, but additional native seed, plugs, and potted plants would be planted that mimic similar species and cover as existing areas that are not disturbed. The salvaged topsoil and sod from the newly filled channel and terraces provide a combination of upland, mesic, and hydric vegetation and a mix from both sources would be used where transplanting would occur. A revegetation plan would be developed detailing these actions.

Conifer Removal

Within Colby and Willow Creek West meadows encroaching conifers less than 12 inches diameter at breast height (DBH) would be removed via a combination of hand thinning; hand piling and burn; lop and scatter or used in the construction of PALS/BDAs. Some conifers between 12 and 24-inch DBH would be removed or utilized where doing so would not impair future large wood recruitment in either streams or fen stands. Conifers functioning as a stabilizing structures on stream banks may also be retained. Conifer removal within 150 ft. of fen stands would be limited to those trees needed for the construction of restoration features, or in areas where lodgepole encroachment has occurred

as a result of hydrologic degradation (e.g. channel incision). Additional hand thinning and lopping within the meadows would be considered a secondary treatment to control conifer regeneration overtime.

Recontouring Roads and Removing/Replacing Culverts

Two roads within the Colby 03 Meadow are proposed for restoration treatments. The roads have been decommissioned and are no longer part of the National Forest road system. Recontouring would include removing short sections (30-45 feet) of the former roadbed (i.e. those covering former wetland areas) with equipment and placing it nearby outside of the flood prone area in the uplands. Along the length of the treatment area, all culverts would be removed, and the roadbed would be reshaped to blend with the natural topography of the area.

The third location includes replacing a culvert under Forest road 26N59, a maintenance level 2 (high clearance vehicles) road. The construction would include replacing an undersized culvert with a larger, more appropriate structure in order to minimize erosion of the stream channel upstream and downstream of the crossing when flood flows exceed the culvert capacity.

Decision to be Made

The decision to be made is: 1) whether to implement the Proposed Action as described above, 2) whether to implement an alternative that better responds to the Purpose and Need, or 3) whether to not implement any action. A decision on this project is expected in the spring of 2021.

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